

METHOD FOR SUPPLYING AND INSTALLATION OF DEVICE-SPECIFIC FUNCTIONALITIES AND/OR DATA FOR THE FIELD DEVICES OF A DISTRIBUTED SYSTEM

5 The invention relates to a system and a method for directed provision and installation of device-specific functionalities and/or information for field devices which are arranged in a distributed system, in particular in a distributed automation system.

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The structure of a distributed system comprises a large number of field devices, which communicate via a network structure, for example via a bus system, with one another and/or with a higher-level control system or controller. Examples of field devices which are used in distributed systems are drives, motor protection units, switchgear assemblies, sensors, in particular sensors for pressure, temperature and flow measurements, low-voltage devices, actuators and/or analysis devices.

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Device information for the field devices in the distributed system, such as device documentation, device core data and device parameters, is stored.

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The functions of the field devices are not just restricted to passing on measurement data or fault messages. The field devices are increasingly being extended with additional functionalities for the configuration, engineering and diagnosis of an automation system, for example with control functions, setting-up functions, diagnosis functions, maintenance functions, optimization functions, alarm processing functions and/or life functions, in which case the additional functionalities must also be integrated separately in each field device.

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A large number of applications for control, for preventative maintenance and for status recording of

the distributed system, which are also known as asset optimization (installation optimization), are also closely related to the field devices and must be installed for the field devices.

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In order to provide the functionality and all of the descriptions which are associated with it and are accessed by a field device over the entire life cycle in the distributed system, complex installation and configuration processes are required for the device-specific functionalities and/or information for the field devices, since the device-specific functionalities and/or information are/is provided separately for each field device and are transmitted to the distributed system.

A further disadvantage is that the device-specific functionalities and/or information for the field devices and the components associated with them are integrated individually in the distributed system. This process is highly time-consuming and is associated with considerable technical effort, thus in particular considerably increasing the setting-up effort.

Components which are necessary in order to address a relevant field device and use it in a given network do not yet exist on the basis of the procedure described above, but are dependent on further configuration and setting-up steps. These components differ, depending on the communication architecture that is used. Fieldbus systems such as FOUNDATION fieldbus, PROFIBUS, PROFINet and/or HART are suitable protocols for communication between the field devices and the higher-level control system or controller. Linking devices (couplers) may represent the corresponding component for the FOUNDATION fieldbus. Corresponding components are provided by remote-I/Os (remote input and output units) for the PROFIBUS.

The invention is accordingly based on the object of providing an arrangement for directed provision and installation of device-specific functionalities and/or information for field devices which are arranged in a distributed system, in particular in a distributed automation system, thus avoiding the disadvantages and problems mentioned above.

10 According to the invention, this object is achieved by an arrangement having the features specified in claim 1. A corresponding method for implementation of the arrangement according to the invention is specified in claim 17.

15 Advantageous refinements and improvements of the apparatus according to the invention are specified in further claims and in the description.

20 The arrangement according to the invention for directed provision and installation of device-specific functionalities and/or information for field devices which are arranged in a distributed system comprises at least one device-specific component which interacts  
25 with at least two functional units which are linked to it, and in which means are provided at least in one device-specific component which automatically results in provision and installation of device-specific functionalities, which are stored in the functional  
30 units, and/or information in the field devices.

The device-specific components relate in particular to device-specific information for drives, switchgear assemblies, instrumentation for positioning states,  
35 pressure, temperature and/or flow rate measurements and low-voltage switching devices as well as functionalities of the field devices which relate to the overall life cycle of the devices. The device-

specific components also relate to information and functionalities. For the planning and configuration which are stored in documentation, device descriptions and/or device drivers, for setting up, which is stored  
5 in additional network components, for operation, which is stored as display elements and documentation, for the diagnosis displays, for linking to maintenance management and for real-time displays of alarm, status and/or event messages, in particular with reference to  
10 asset management (installation management).

The device-specific functionalities and/or information which interact/s with the device-specific components are/is recorded as data structures and/or program  
15 components in the device-specific components, such that each component comprises only functionalities and/or information for the device type associated with it. The arrangement according to the invention also has a plurality of device-specific components which each  
20 relate to different device types, and is preferably stored in a memory medium.

The functional units are used in particular to store device information, such as device documentation and/or  
25 device core data and/or device parameters and/or device drivers, as well as control functions and/or setting-up functions and/or diagnosis functions and/or maintenance functions and/or optimization functions and/or alarm processing functions and/or life functions for  
30 integration of the field devices in the distributed system.

Device-specific functionalities and/or information for the functional units in the arrangement according to  
35 the invention which is stored in a memory medium are/is provided and installed in a higher-level control system or controller which, in particular, is a process control system or a programmable logic controller,

relating to the distributed system for the field devices, in an advantageous manner by means of a single automatically running installation process.

5 Alternatively, the installation of the arrangement according to the invention which is stored in the memory medium is provided by each processor unit/computer unit which is connected to the distributed system.

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In one advantageous development, the arrangement according to the invention is extended by configuration tools for installation of the communication between the field devices and/or with the higher-level control  
15 system or controller, in particular for the configuration and setting up of the field devices. Means are therefore available which carry out efficient and optimized configuration of the field devices in the distributed system.

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In a further advantageous development, the arrangement according to the invention has network components, for example for linking devices (couplers) and remote input/output units for the FOUNDATION fieldbus, the  
25 PROFIBUS or the PROFINet, for installation of the network links for a specific communication architecture.

By way of example, the network components have  
30 information and/or functionalities for specific bus protocols such as HART (Highway Addressable Remote Transmitter), PROFIBUS, PROFINet, FOUNDATION fieldbus. The information and/or the functionalities can thus be installed separately for specific bus protocols, or  
35 alternatively can be installed at the same in order to form a heterogeneous communication system.

The configuration tools and/or network components can be installed in the same manner as the device-specific components in an installation process by the higher-level control system or controller for the field  
5 devices.

In an alternative embodiment, selective installation is also provided for the device-specific components, for the configuration tools and for the network components  
10 for the field devices, which are stored in the arrangement according to the invention.

The arrangement according to the invention is advantageously designed such that means are provided in  
15 the device-specific components for testing the correctness and/or completeness of the device-specific functionalities and/or information.

The provisions on the device-specific components can  
20 advantageously be extended or reduced in one method step by at least one further device-specific functionality and/or information item or items.

A computer program for carrying out the arrangement  
25 according to the invention on an appropriately configured data processing device, in particular the higher-level control system or controller, which has the features of the method according to the invention leads to one preferred embodiment of the arrangement  
30 according to the invention. A computer program, in particular a computer program which is stored in a data storage medium, and which has the features of the method according to the invention is thus expressly included in the disclosure content of the present  
35 application.

Since the functionalities' are combined on a device-specific basis in the arrangement according to the



invention, this results in a simplified, clear structure for provision and installation in the distributed systems, which are in particular in the form of fieldbus systems.

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The method by means of which the object is also achieved can be found in claim 17. Device-specific functionalities and/or information for the field devices are/is thus provided and installed  
10 automatically by means of at least one device-specific component, which interacts with at least two functional units which are linked to it.

The method according to the invention efficiently  
15 assists and simplifies the provision and installation of device-specific functionalities and/or information for the field devices in a distributed system, as well as considerably reducing the procedures involved, in particular during setting up.

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The invention as well as advantageous refinements, improvements and further advantages of the invention will be explained and described in more detail with reference to exemplary embodiments which are  
25 illustrated in the drawing figures 1 to 4, in which:

Figure 1 shows one exemplary embodiment of the arrangement according to the invention for directed provision and installation of  
30 device-specific functionalities and/or information for field devices which are arranged in a distributed system,

Figure 2 shows an example of the integration of the device-specific functionalities and/or  
35 information for a field device, and the use of the device-specific functionalities and/or information in the distributed system,

Figure 3 shows one exemplary embodiment relating to the implementation of the method according to the invention for directed provision and installation of device-specific functionalities and/or information for field devices which are arranged in a distributed system, and

Figure 4 shows one exemplary embodiment of the arrangement of the field devices in a distributed system.

Figure 1 shows one exemplary embodiment of the arrangement according to the invention for directed provision and installation of device-specific functionalities and/or information for field devices which are arranged in a distributed system and comprise a plurality of device-specific components 20.

The device-specific components 20 relate in particular to device-specific information for drives, switchgear assemblies, instrumentation for positioning states, pressure, temperature and/or flow rate measurements, and low-voltage switching devices, as well as functionalities of the field devices over the entire life cycle of the devices for planning and configuration, for setting up, for operation, for diagnosis displays, for linking to maintenance management and for real-time displays for alarm, status and/or event messages, in particular for asset management (installation management).

The device-specific components 20 for this purpose interact with at least two functional units 30 which are linked to them, with the functional units 30 being used to store device information, such as device documentation and/or device core data and/or device parameters and/or device drivers, as well as control functions and/or setting-up functions and/or diagnosis



functions and/or maintenance functions and/or optimization functions and/or alarm processing functions and/or life functions for integration of the field devices in the distributed system.

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The device-specific components 20 also have means, such as device descriptions or drivers, which automatically provide and install device-specific functionalities and/or information for the field devices, which are  
10 stored in the functional units 30.

The device-specific functionalities and/or information which are/is stored in the arrangement according to the invention are/is recorded as data structures and/or  
15 program components in the device-specific components 20, such that each component has only functionalities and/or information for the device type associated with it.

20 The device-specific components 20 are extended such that it is possible to test the correctness and/or completeness of the device-specific functionalities and/or information.

25 The arrangement according to the invention can be extended by at least one configuration tool 50, for example by a setting-up component, which assists the installation of the communication between the field devices and/or with the higher-level control system or  
30 controller.

Furthermore, network components 40 are integrated in the arrangement according to the invention, such as a component for a linking device, for installation of the  
35 network links for a specific communication architecture.

For installation that takes place automatically, the arrangement according to the invention is stored with the functionalities and/or information which are/is stored in the device-specific components 20, the network information which is stored in the network components 40, and the configuration instructions which are stored in the configuration tools 50, in a memory medium 60 which can be transmitted to the field devices via the distributed system by means of a processor unit/computer unit in the higher-level control system or controller.

The installation of the arrangement according to the invention which is stored in the memory medium 60 can optionally be carried out with the device-specific functionalities and/or information which are/is stored in the device-specific components 20, the network information which is stored in the network components 40 and the configuration instructions which are stored in the configuration tools 50, by each processor unit/computer unit which is connected to the distributed system.

Figure 2 shows an example of the integration of the device-specific functionalities and/or information for a field device 70, for example a drive, a motor protection unit, a switchgear assembly, a sensor, in particular a sensor for pressure, temperature and flow rate measurements, a low-voltage device, an actuator or an analysis device, and the use of the device-specific functionalities and/or information in the distributed system.

The field device 70 which is used in the distributed system is normally equipped with firmware by the device manufacturer. However, further device-specific functionalities and/or information, such as device documentation, device drivers, device core data, device

parameters, control functions, setting-up functions, diagnosis functions, maintenance functions, optimization functions, alarm processing functions and life functions, are required for integration of the field device 70 in the distributed system. These device-specific functionalities and/or information are/is stored in the functional units 30 of the corresponding device-specific components 20, is or are made available by the arrangement according to the invention, and is or are transmitted to the distributed system.

For integration of the remote I/O and linking devices 80 in the distributed system, the arrangement according to the invention is extended by network components 40 in which the information and functionalities are stored for installation of the network links for a specific communication architecture, for example for the FOUNDATION fieldbus and/or the PROFIBUS, and/or the PROFINet and/or the HART.

The device-specific functionalities and/or information which are/is stored in the arrangement according to the invention are/is also used in the distributed system, for example in the installation planning 91, in the installation operation 92 and in the installation optimization 93. In this case, installation planning includes in particular functional diagrams, device parameters for setting up and/or device description files, and/or device drivers and/or device core data files. Installation operation includes display elements, device managers for the display and/or the trend profile, device documentation and/or alarm actions or processing operations. The optimization functionality addresses the maintenance, calibration management and/or real-time monitoring of the installation and of installation components.

Figure 3 shows one exemplary embodiment relating to the implementation of the method according to the invention for directed provision and installation of device-specific functionalities and/or information for field  
5 devices 70 which are arranged in a distributed system.

In a first step 1, the device-specific functionalities and/or information for the device-specific components 20 and the functional units 30 which interact with the  
10 device-specific components 20 and are linked to them, as well as the network components 40 with information and functionalities for communication via the distributed network are/is created and stored in a memory medium 60, with a check for correctness and/or  
15 completeness being carried out before storage of the device-specific functionalities and/or information.

In a second step 2, the device-specific components 20 which interact with the functional units 30 and the  
20 network components 40 carry out an installation process, which takes place automatically, such that the device-specific functionalities and/or information are/is provided and installed in a higher-level control system or controller 90 via the distributed system for  
25 the field devices 70, in a single installation process, which takes place automatically.

The network components 40 are provided for installation of the network links for a specific communication  
30 architecture, for example for a fieldbus protocol in the form of PROFIBUS and/or PROFINet and/or FOUNDATION fieldbus and/or HART.

Once the functionalities and/or information have/has  
35 been successfully installed in the higher-level control system or controller 90, at least one device-specific component 20 is produced in the higher-level control system or controller 90 in a step 3. The device-

specific functionalities and/or information which are/is stored in the functional units 30 are/is provided and installed in a higher-level control system or controller 90, for example by instantiation of  
5 previously configured device-specific components 20.

For the installation of the communication between the field devices 70 and/or with the higher-level control system or controller 90, the arrangement according to  
10 the invention is extended by configuration tools 50 which, in a fourth step 4, assist the system configuration, in particular the communication with the field devices 70 during the setting up and configuration of the field devices 70.

15 In an alternative embodiment, the device-specific components 20, the configuration tools 50 and/or the network components 40 can also be installed selectively for the field devices 70.

20 In one particular embodiment of the method according to the invention, the device-specific components 20 have at least one device-specific component 20 added to them or removed from them by means of a program approach in  
25 a further step.

Figure 4 shows one exemplary embodiment of the arrangement of the field devices 70 in a distributed system, in which the higher-level control system 90 is, for  
30 example, a process control system or a programmable logic controller, and communicates with the field devices 70 via linking devices 80 and remote I/O 80.